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Development of Pediatric Cardiology in Latin America: Accomplishments and Remaining Challenges

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Abstract

Until the first quarter of the 20th century, most physicians were more than happy to differentiate congenital heart lesions from rheumatic heart disease, which then was rampant. As early as 1932, Dr Rodolfo Kreutzer, from Buenos Aires, Argentina, was already involved in the study of congenital heart defects. He started off assessing children with a stethoscope and with Einthoven electrocardiography equipment. The cardiac unit at the Buenos Aires Children's Hospital was created in 1936. It established the onset of pediatric cardiology in Argentina and fueled its development in South America. Nearly at the same time, Agustin Castellanos from Cuba also became a pioneer in the assessment of congenital heart disease. He described the clinical applications of intravenous angiocardiography in 1937. Meanwhile in Mexico, Dr Ignacio Chavez founded the National Institute of Cardiology in 1944 in Mexico City. It was the first center in the world to be exclusively devoted to cardiology. From this center, Victor Rubio and Hugo Limon performed the first therapeutic cardiac catheterization in 1953. Meanwhile, Professor Euriclydes Zerbini from Sao Paulo, Brazil, built the largest and most important school of cardiac surgeons in South America. In Santiago, Chile, the Calvo Makenna Hospital was the center where Helmut Jaegger operated on the first infant with extracorporeal circulation in Latin America in 1956. The patient was a 1-month-old baby, with complete transposition of the great arteries, who underwent an Albert procedure. Currently, there are many fully equipped centers all over the region, capable of dealing with most lesions and of providing excellent medical, interventional, and surgical treatment. Outcomes have improved substantially over the last 20 years. These achievements have gone beyond our pioneers' dreams. However, many neonates and young infants die prior to surgery because referral centers are overburdened and have long surgical waiting lists. Clearly, we still have to mastermind and establish sustainable public health policies to overcome these challenges.

Keywords

congenital heart disease, pediatric cardiology, pediatric cardiac surgery, history of pediatric cardiology, pioneers of pediatric cardiology, development of pediatric cardiology in Latin America, achievements and drawbacks of pediatric cardiology in Latin America

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In order to put in perspective the origin and growth of pediatric cardiology in Latin America, we will highlight some early milestones in the history of pediatric cardiology. Until the first quarter of the 20th century, cardiology as a medical specialty arose from early anatomical descriptions of congenital cardiac defects. Only a few clinical diagnoses were made during life.[1] Most physicians were more than happy to differentiate congenital heart lesions from rheumatic heart disease, which then was rampant. Those few pediatricians interested in cardiology taught themselves.

Physicians and Centers

Actually, the number of relevant people who have contributed to the growth and development of pediatric cardiology in Latin America is really large. Only a few of the most prominent will be mentioned here. As early as 1932, Dr Rodolfo Kreutzer (1900-1978) from Buenos Aires, Argentina, was already concerned with the impact rheumatic fever had on the morbidity

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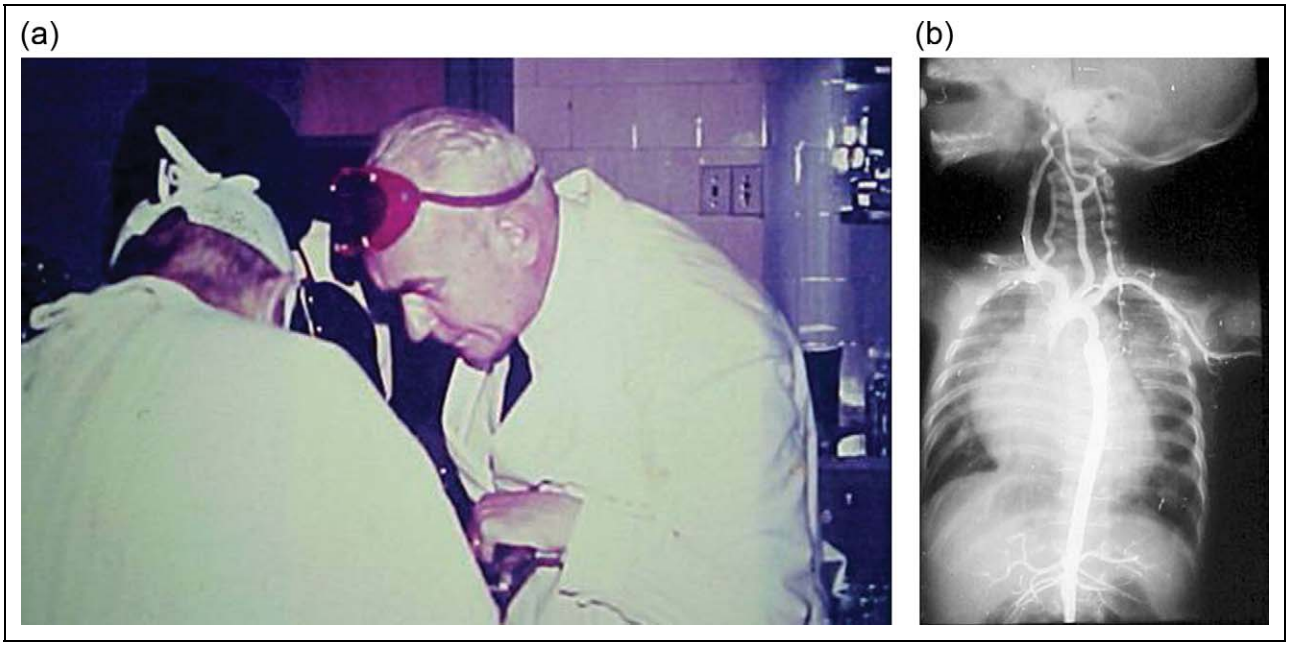

Figure 1. (A) Rodolfo Kreutzer (Buenos Aires, 1900-1978) performing retrograde arterial angiocardiography in an infant with aortic coarctation in 1951. (B) Aortogram.

and mortality of children.[2,3] At the time, 7 of 10 children with a heart ailment had rheumatic heart disease. He was also deeply involved in the clinical diagnosis of congenital heart defects.[4-6] So, he began assessing children with a stethoscope and with Einthoven electrocardiography (ECG) equipment, which had only 3 leads. Then, the cardiac unit at the Children's Hospital was created in 1936.

Among Kreutzer's associates were Gustavo Berri, who later would run the cardiac department from 1968 for over 20 years; Juan Alberto Caprile, trained at Johns Hopkins; Juan Marletta; and Gonzalez Parente, who would develop the catheter laboratory in the mid-1950s. They established pediatric cardiology in Argentina, and subsequently, fueled its development in South America. Actually, they were all pediatricians who needed some guidance from cardiologists. They received a great deal of help and advice from Pedro Cossio (1900-1986), an emblematic figure of Argentine cardiology, who became consultant at the Children's Hospital. Pedro Cossio, jointly with Tiburcio Padilla and Isaac Berconsky, performed in 1932 the first cardiac catheterization in the Americas and the fourth in the world.[7-10]

Agustin Castellanos (1902-2000) from Havana, Cuba, also became a pioneer in the assessment of congenital heart defects. He was convinced that an appropriate contrast substance could be used for the in vivo visualization of the cardiac chambers. In 1937, Castellanos and his coworkers published a landmark paper on the clinical applications of intravenous angiocardiography.[11] He described the normal patterns of cardiac chambers and great vessels and also those in ventricular septal defects (VSDs) and pulmonary stenosis. Subsequently, in 1940, his team reported the method of retrograde injection of dye into the aorta.[12] This aortography was mainly used to evaluate aortic coarctation and a patent arterial duct. Castellanos's work quickly achieved recognition among physicians, mainly from Spanish-speaking countries. After reading his innovative papers, Rodolfo Kreutzer immediately wrote to Castellanos to find out the exact dose of substance to be used in children, according to age and weight. Castellanos promptly answered and generously provided all the details for a successful procedure, and at the end of the letter, he added the following: "It is a truly revolutionary diagnostic method. . . . It is like performing a cardiovascular necropsy in a living child." The content of this letter was disclosed by Kreutzer in his first publication on angiocardiography in children in 1943 (Figure 1).[13]

Mexico honored Castellanos by including his image in Diego Rivera's mural "Great Men of Cardiology," which stands at the National Institute of Cardiology in Mexico City. It was a special request of Dr Ignacio Chavez (Figure 2). On the upper left side of this beautiful mural, painted in 1943, 2 relevant people related to the history of congenital heart disease were portrayed: Karl Rokitansky (1804-1878), an anatomist and pathologist from Vienna who first described the anatomy of the congenitally corrected transposition, and Maude Abbott (1869-1940), a renowned Canadian physician who published the famous atlas of 1000 anatomical specimens of heart defects. She was the only woman scientist depicted in the mural. Just on the middle right side of it, Castellanos is portrayed near to the fields of radiology and angiocardiography.

In 1944, Dr Ignacio Chavez (1897-1979), considered to be the master of Mexican cardiology, founded the National Institute of Cardiology in Mexico City. It was the first center in the world to be exclusively devoted to cardiology. El Maestro Chavez, as he was called by his disciples and colleagues, was the director of the Institute from 1944 until 1961.

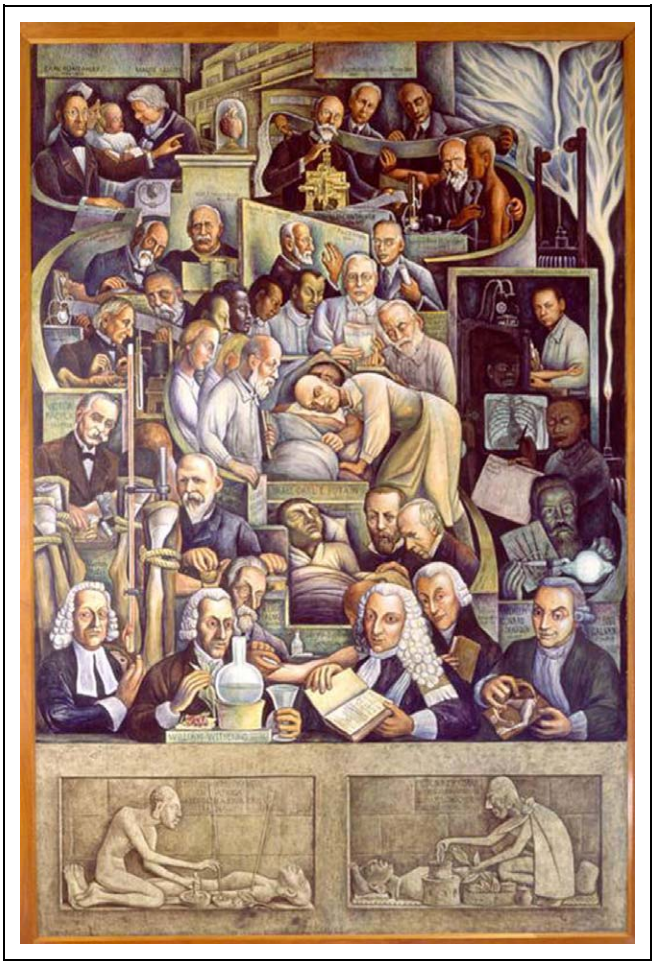

Figure 2. Diego Rivera's mural "Great Men of Cardiology," which stands at the National Institute of Cardiology in Mexico City. On the middle right side, Castellanos is depicted near to the fields of radiology and angiocardiography.

A large number of Spanish-speaking cardiologists, both pediatric and adult, were trained in this famous institute. Chavez had learned the skills of the French school of cardiology in Paris and had a particular interest in congenital heart disease. Among his many scientific contributions, he published an excellent paper on selective angiocardiography in congenital and acquired heart disease in 1947.[14] From this institution, many relevant contributions to ECG were made by the Mexican school of electrocardiography led by Demetrio Sodi Pallares, Jorge Espino Vela, and Enrique Cabrera. Their remarkable studies and description of systolic and diastolic overload patterns of both ventricles, as well as the ECG patterns in several congenital heart lesions, have stood the test of time and remain as relevant information in today's clinical practice.[15,16] In addressing the field of ECG, it is of note that the first description in the world of a congenital atrioventricular block was reported by a smart pediatrician from Uruguay, Luis Morquio, as early as 1901.[17]

Sao Paulo, Brazil, was another important center for pediatric cardiology in South America. This group was initially formed

Figure 3. Euryclides Zerbini (left) (Sao Paulo, 1912-1993) with his distinguished disciple Guillermo Kreutzer (right).

by Radi Macruz, Munir Ebaid, Rachel Snitcovsky, Ademar Atik, and others. They initially worked with Hugo Felipozzi, a talented surgeon from Sao Paulo, who performed Brazil's first operation with extracorporeal circulation at Sabaddo D'Angelo Institute of Sao Paulo. Later, Professor Zerbini (1912-1993) at Hospital de Clinicas started the most important cardiovascular surgery program for the surgical treatment of congenital heart defects. He will be remembered for building the most important school for cardiac surgeons in South America, where hundreds of excellent cardiovascular surgeons were trained (Figure 3).

The Calvo Makenna Hospital in Santiago, Chile, was another distinguished South American cardiology center. Fernando Eimbcke, a pioneer of Chilean pediatric cardiology, and his colleagues worked jointly with Helmut Jaegger, an outstanding Chilean cardiovascular surgeon who operated on the first infant in Latin America in 1956. The patient was a 1-month-old baby with transposition of the great arteries (TGA) who underwent an Albert procedure, similar to a Mustard operation (F. Eimbcke, personal communication).

Cardiovascular Pathologists

In the 1950s, 2 eminent pathologists profoundly contributed to the understanding of embryology and morphology of simple and complex heart lesions: Maria Victoria de la Cruz (Sancti-Spiritus, Cuba, 1916-1999) from the Institute of Cardiology in Mexico City and Luis Becu (Buenos Aires, Argentina, 1927-1997) from the Buenos Aires Children's Hospital. De la Cruz's unique and smart investigation on living chicks' embryos was summarized in 2 important books: *Development of the Chick Heart* and *Living Morphogenesis of the Heart*.[18,19] Reading both is a must for students and practitioners to decipher the development of the early stages of the fetal heart and particularly of the conotruncal abnormalities.

Luis Becu trained with Jesse Edwards at the Mayo Clinic. He arrived at a propitious time and so had the privilege of

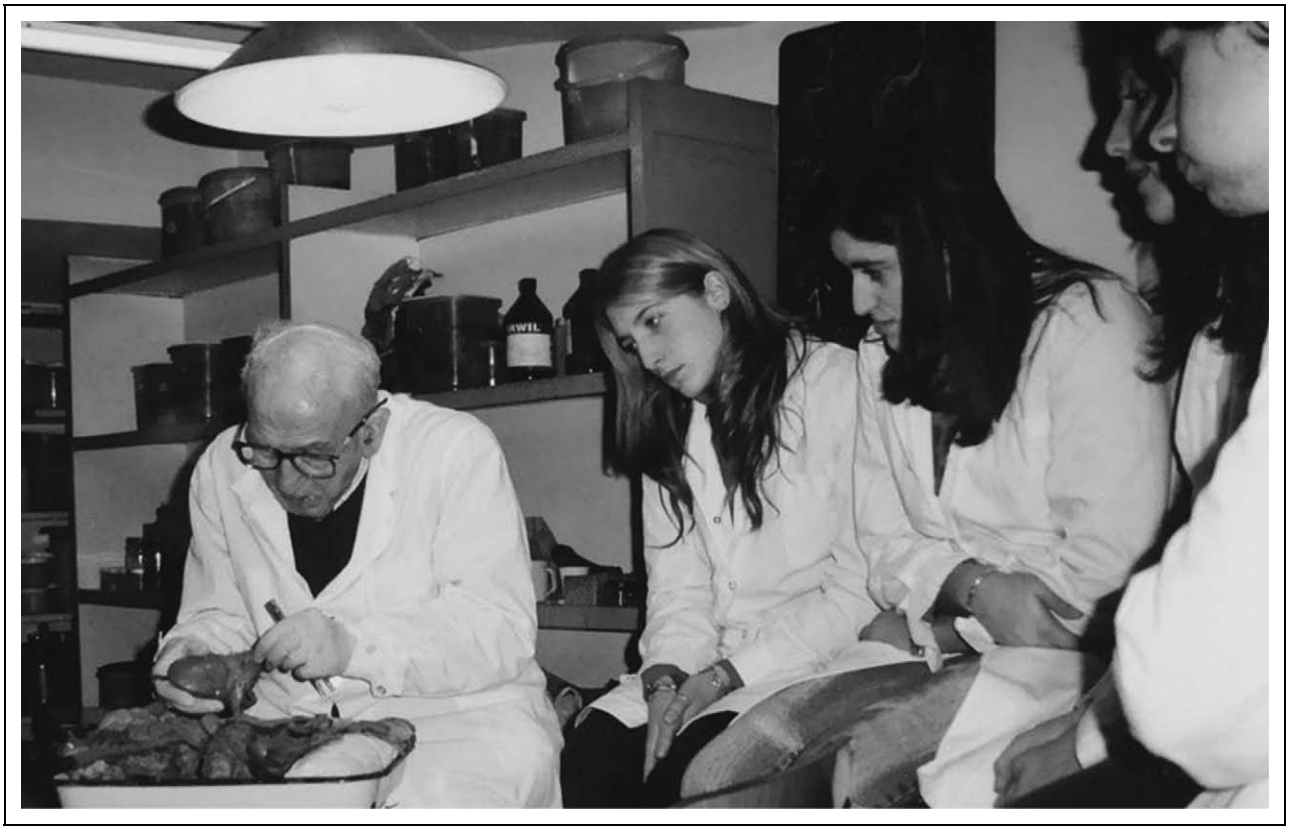

Figure 4. Professor Alfonso Albanese (1906-2009) at age 97 years teaching anatomy at the School of Medicine of Buenos Aires University.

joining John Kirklin's surgical group when they performed the first open heart operation in 1955. Not infrequently, in those early days, he used to be required in the operating room to unravel the anatomical mysteries of hearts undergoing repair. He was an outstanding cardiovascular pathologist with a brilliant mind, which enabled him to take a new look at old matters usually not perceived by others. The term "higgledy-piggledy" to describe the myocardial disarray often found in some forms of diffuse cardiovascular disease shows his provocative and humorous style in reporting his anatomical findings.[20,21] Becu's anatomical classification of VSDs in the mid-1950s still is currently used in many surgical reports.[22] Besides, it was the guide and main source of anatomical information for one of us to report, in the early 1980s, a 2-dimensional echocardiographic classification of VSD.[23]

Interventional Cardiac Catheterization

William Rashkind and William Miller described the first balloon atrial septostomy in patients with TGA in 1966, and it was the beginning of interventional cardiac catheterization in the world.[24] Alberto Rodriguez Coronel, who had trained with Miller in Chicago, performed the first atrial septostomy in a neonate with TGA at the Buenos Aires Children's Hospital in 1967. Likewise, in the same year, Alfredo Vizcaino Alarcon also did a Rashkind procedure at the Children's Hospital in Mexico City. The first balloon pulmonary valvuloplasty in Latin America was performed by Valmir Fontes at the Dante Pazzanese Institute in Sao Paulo in 1982.[25] However, it should be mentioned that the first therapeutic cardiac catheterization procedure in the world was performed by Victor Rubio and Hugo Limon in 1953 in Mexico.[26,27] They opened the pulmonary valve by pulling a wire mounted at the tip of an arced catheter across the valve. It was published almost 30 years before the landmark report by Kan et al,[28] which described balloon pulmonary valvuloplasty. The procedure had not been repeated by others, and thus, it was unfortunately forgotten.

Meetings and Societies

The Fourth Panamerican Congress of Cardiology was held in Buenos Aires in 1952. A significant number (over 200) of closed surgical procedures had been successfully performed and reported by Alfonso Albanese (1906-2009) from Buenos Aires (Figure 4).[29] Helen Taussig (1898-1986) attended the meeting and was impressed with this large surgical series and excellent results. Thus, she decided to visit the Buenos Aires Children's Hospital, where she shared her vast knowledge and experience with the local colleagues (Figure 5). In 1953, the VII International Congress of Pediatrics was held in La Habana. The scientific program included a roundtable on surgery of congenital heart defects. The participants were Helen Taussig, John Lind from Sweden, and 3 "big guns" from Latin America: Agustin Castellanos, Ignacio Chavez, and Rodolfo Kreutzer.

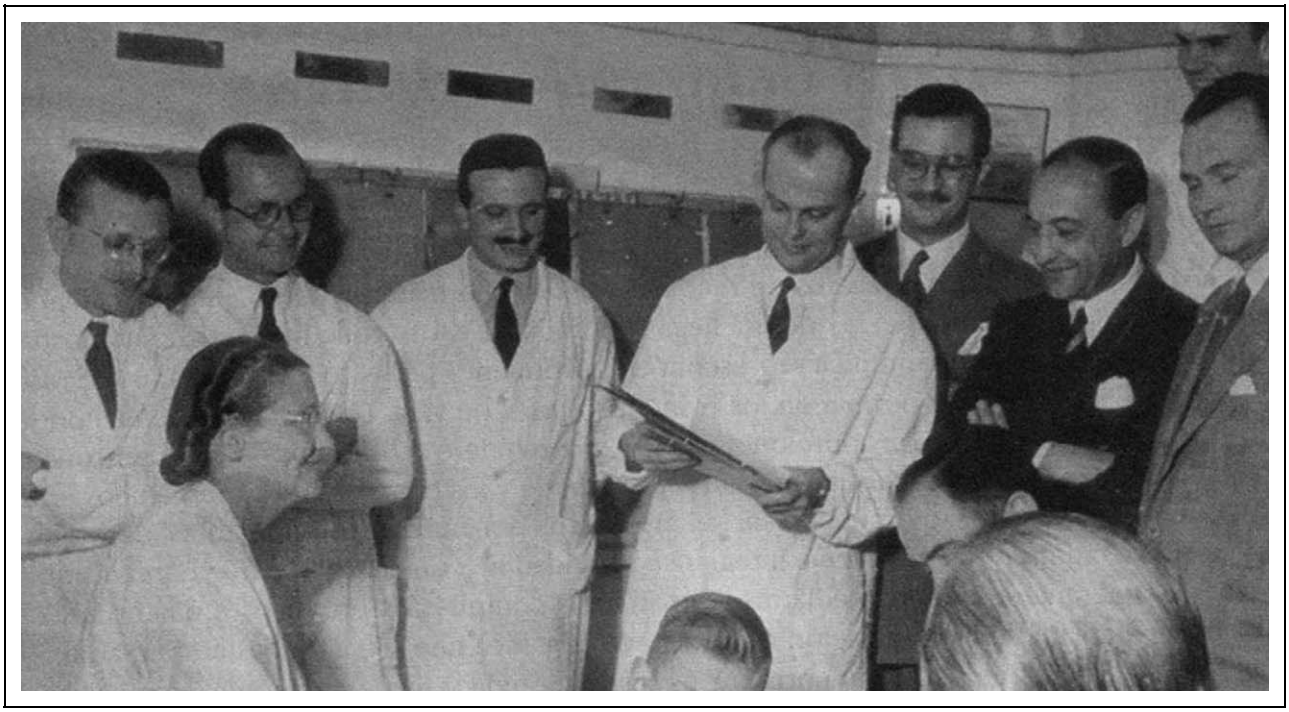

Figure 5. Helen Taussig (1898-1986) assessing a patient at the Buenos Aires Children's Hospital in 1952.

Many years later, in 1974, the idea of creating a Latin Society of Pediatric Cardiology and Cardiac Surgery was first conceived. It was in Caracas at the time of the Latin American Congress of Cardiology. It was masterminded and put forward by some prominent Latin American pediatric cardiologists and surgeons, jointly with Manuel Quero Gimenez and Pedro Antonio Sanchez from Spain. The late Manuel Quero Gimenez (1941-2003) was an outstanding Spanish pediatric cardiologist with a vast knowledge of cardiac morphology. The first Congress of the Society, however, was held in Oaxtepec, Mexico, in 1982. It was hosted by Carlos Perez Treviño and Alfredo Vizcaíno Alarcon. Since 1982, the Congress has been staged successfully, every other year, in different Latin countries, either in Europe or in America. In 2005, the Congress of the Latin Society was held jointly with the Fourth World Congress of Pediatric Cardiology and Cardiac Surgery in Buenos Aires. It gathered 3000 delegates—the largest attendance ever. Many Latin Americans were able to attend a World Congress for the first time.

Current Situation: Achievements and Drawbacks

We have tried to summarize how and where all these endeavors started in our region. Latin America has been characterized as having endured a long-standing deep social crisis. There has always been a big gap between the "haves" and the "have-nots." Nevertheless, despite the ups and downs of our emerging economies and somewhat unpredictable governments, we have come a long way until today's reality. Definitely, our achievements have gone beyond our pioneers' dreams. We count now a large number of fully equipped centers, all over the region, capable of dealing with the whole spectrum of heart lesions and of providing excellent medical, interventional, and surgical treatment. A good example of the latter is the Garrahan's children's hospital in Buenos Aires. It runs the largest pediatric cardiology program in Argentina. Over 800 children are operated on every year with an overall mortality less than 5%. Certainly, our outcomes have improved substantially over the last 20 years.

There is still plenty of room for improvement. Certain flaws and drawbacks have to be recognized and confronted. The vast majority of the population with congenital heart disease in Latin America depends on the public health system.[30,31] This results in overburdened referral centers, long surgical waiting lists, delayed hospital admissions, and probably higher morbidity and mortality rates. Furthermore, many patients are unable to get access to treatment. The following example will provide insightful information on this thorny issue: In Argentina, around 3500 children need cardiac surgery each year. However, only 2500 reach the opportunity to get access to treatment. Regarding this, we have documented, with death certificates, that around 1000 children per year, most of them neonates and young infants, die with an untreated congenital cardiac defect.[32] It should be emphasized that these are preventable deaths that have a significant impact on the global children's mortality rate.

Future Prospects

Clearly, we still have to mastermind and establish public health policies to tackle our deficits and flaws. Only setting up sustainable national programs will allow most children born with a heart defect to get access to treatment. In order to succeed in

this serious issue, we must take some steps in the right direction. These will have to include, among others, the following: increasing the number of centers able to cope with high complexity procedures, improving the diagnostic facilities and transportation from distant geographical regions, and addressing the long surgical waiting lists. Other remaining challenges for Latin America include the following: improving the development of prenatal diagnosis, organizing effective follow-up after surgery, and creating specialized centers to deal with the increasing community and new problems of adult congenital heart disease, particularly with their surgical treatment.[33] Finally, we must also devote time and effort to the development of research in basic sciences.

We wish to round off this report with some acknowledgments. We owe special recognition to some Latin American surgeons who work or have worked in the United States and have made significant contributions to our specialty for a great deal of time: Aldo Castañeda, Francisco Puga, Eduardo Arciniegas, and Pedro del Nido, among many.

Also, we feel a genuine indebtedness to 2 people who have had a long-standing love affair with Latin American countries. We refer to the late and great Bob Freedom (1941-2005) and to our dear friend Jane Somerville. Their commitment, support, and innovative thinking strongly influenced the development of pediatric cardiology in the whole region. Although not born in Latin America, both are Latin at heart.

Finally, we wish to express our gratitude to Aldo Castañeda, an outstanding pediatric cardiac surgeon. Clearly, he has been an inspiring figure to all of us. Nearly all Latin American surgeons have visited him in Boston, looking for training, valuable information, or some piece of advice. He has always been eager and willing to help and keeps showing a deep interest and commitment to our problems and needs. His multiple scientific contributions to pediatric cardiac surgery have earned the admiration of contemporary pediatric cardiologists and cardiac surgeons alike. Definitely, he belongs to a special breed of surgeons, and that is why the tribute to him by organizing a Special Joint Symposium in Antigua, Guatemala, was an unforgettable and moving experience.

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